Durham
Warm Air Furnace
Company.

8

THE DURHAM PATENT

WARM AIR FURNACE

MANUFACTURED BY

DURHAM WARM AIR FURNACE CO.,

Sole Licencees of Patents issued to C. W. Durham.

OFFICE:

Rooms 27 and 28, No. 79 Dearborn St.,

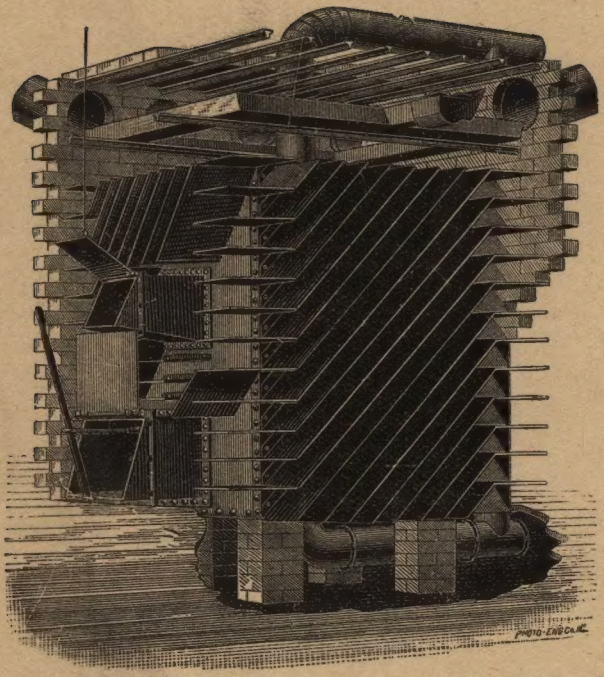
WORKS:

Nos. 367 and 369 Illinois Street,

CHICAGO.

ADAM CRAIG & CO., PRINTERS, 100-102 MADISON ST.

1883.



TDCAT 1883
HFPAPV03B539

THE DURHAM WARM AIR FURNACE

HAS successfully passed the extremely severe tests of the past six winters. It has proven to be very *elastic* in capacity, being equally well adapted to climatic temperatures of 50° above or 30° below zero. Thus, while the *quality* of the warm air supplied is the great merit in the apparatus, its tremendous *capacity for heating* has been demonstrated in a most gratifying manner.

For the present season several progressive features have been added, which are described in the following pages, making the apparatus more perfect in those respects; and it is now offered to the public with perfect confidence of its merits after a thorough experience of its qualities.

It would be hopeless to attempt to make any *claims* for this furnace which are not already made with great vehemence for every furnace in the market; therefore, in this pamphlet, we seek to follow *a line of argument* illustrating our conclusions, and addressing ourselves to the intelligence of the reader.

HEATING BY WARM AIR.

The principle of the hot-air furnace is correct; the common application of that principle is vicious. The very name should condemn a heating apparatus; for if it supplies "hot air," it is lacking in the most essential qualification for its office, viz: an extensive and well protected radiating surface. And again, if the furnace be well designed as to its radiating surface, there is universally a violation of mechanical laws in the use of materials and workmanship, *for the purpose of producing a cheap article that will sell readily.*

GAS TIGHT FURNACES.

For instance, every furnace manufactured is advertised as gas-tight, when really few of them are so, *when in use.* If the reader will stop to think, he will detect the attempt to humbug him by remembering that in cast iron furnaces the several pieces rest one on another, or are bolted together and *cemented;* that it is impossible in this way to keep the joints tight, for when the iron is expanding from the heat of a fire the cement or putty is not similarily affected. Such furnaces have to be taken down and reputtied when the effusion of gas becomes insupportable. The improvement on the old cast iron furnace—the so-called "Wrought Iron Furnace"—is open to the same objection, but in a less degree, being a sheet iron drum resting on, but in no way *joined to*, a cast iron ash pit, and between the two parts the gas is drawn out by the suction of the hot-air pipes.

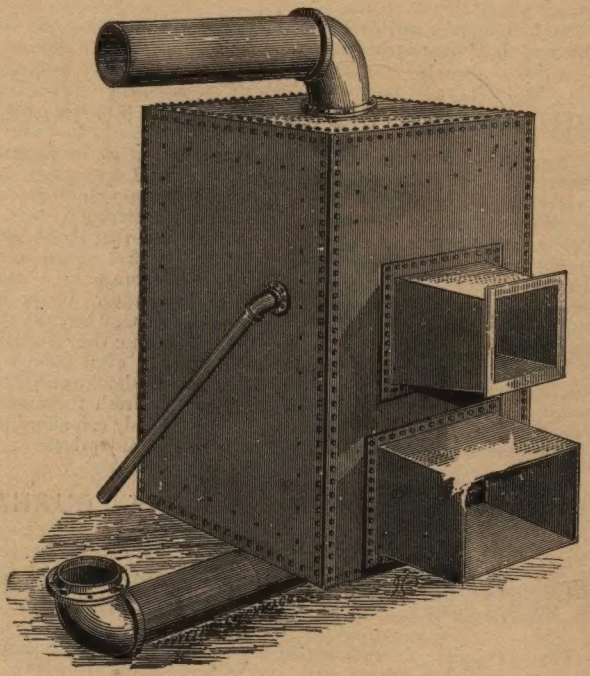
Another class of furnaces use sheet iron flues to extend the radiating surface, and it is likewise impossible to make these gas tight, for the reason that the flues are made of thin sheet iron, and *connected* with the cast iron parts of the furnace by puttied joints, which open from expansion by heat.

WHAT CONSTITUTES A GAS-TIGHT FURNACE.

On reflection, it must be plain to every one that to construct a gas-tight fire chamber or radiator, the practice of the boilermaker must be followed, and his material mainly used. The riveting together of two sheets of boiler iron makes them essentially one piece of metal; but the rivets must be close, to prevent *buckling* when expanding from heat, and they must be driven hot, so that the contraction of the rivet in cooling will draw the two sheets of metal into the closest possible contact, and thus make a gas or steam-tight joint.

The engraving on the following page represents the radiator of the Durham Brick-set Furnace, which is rectangular box of boiler iron, constructed on an interior frame of angle iron. The crown sheet, or top, of the radiator is of No. 7 (3-16) iron, protected around the smoke-hole from intense heat by a concave circular casting. The sides and bottom are of No. 10 (⅛) iron, all riveted together with ⅜ rivets, 1½ inches from center to center, and spreading ¾ of an inch when driven, so that the edges of the rivets are but ¾ of an inch apart. The coal and ash chutes are riveted to the radiator in the same manner. All rivets are driven hot; and the reader should understand that th ere is

a cheaper and quicker method of doing this work, by using annealed rivets and driving them cold, which method is used in the construction of the ordinary wrought iron furnace.



To sum up, no furnace can be gas-tight unless it is steam-tight, and to be steam-tight, it must be made like a steam boiler. The radiator of the Durham Furnace is so made, AND IT IS THE ONLY ONE SO MADE. Within this radiator the fire-pot is placed, and there is no possibility of the escape of coal gas into the warm air chamber. The radiator is really one piece of metal throughout, and there are no joints which can be affected by expansion from heat.

DIMENSIONS OF RADIATORS.

The radiators for brick-set furnaces are all five feet high, and forty inches and thirty-four inches square.

LIMITED RADIATING SURFACE IN FURNACES.

The next important feature in furnaces is the amount of radiating surface and its protection from *intense* heat. Leaving cast iron furnaces out of consideration, as being notoriously unfit for use, because they present a very limited and red hot radiating surface, we find by actual measurement of three popular styles, that the so-called wrought iron furnaces have from forty to sixty-five square feet of radiating surface; the flue furnaces somewhat more. As a consequence of this limited surface, a very high temperature in the iron becomes necessary, or, as is commonly done in cold weather, the air is taken from the sub-cellar or basement hall, because the furnace can not sufficiently warm the cold air from without, even though the radiating surface be red hot. Either consequence should condemn a furnace as unfit for use. The air should be taken fresh from outside of the house at all times, day and night. Everybody can afford pure air, and a furnace that does not supply it is dear at any price.

RADIATING SURFACE IN THE DURHAM FURNACE.

The area of radiating surface in the Durham Brick-set Furnace is:

40 inch furnace, - - - - 566⅔ square feet.
34 " " - - - - - 472 " "

The frontispiece shows how this large radiating surface is secured. Successive radiating plates start at the bottom on all sides of the furnace; and run continuously around it, ascending at an angle of 45 degrees, until the top is reached. These plates are made of No. 20 sheet iron, flanged along the edges to present a surface for contact with the hot radiator (to which they are bolted), the result being a diffusion of the heat in the radiator throughout the large surface of the radiating plates, and as a consequence preventing a high temperature in the walls of the radiator. The air is thus held and compelled to pass over a greater length of surface than if it ascended directly. It is also compelled to turn a corner, and the current of air flowing

between two contiguous plates being thus deflected, is broken up and more thoroughly warmed throughout. This is an application of the principle of the dividing flue in the steam boiler, and its practical working is one of the most successful features of this furnace.

The element of friction is made use of also to control the speed of these air currents, the distance between the radiating plates being so adjusted as to hold the air a sufficient time to allow of its becoming thoroughly warmed with a moderate degree of heat in the metal. The fire is in the center of this large mass of metal, through which the heat is equally diffused at a mild temperature, while the incoming cold fresh air, being subdivided into a large number of thin currents flowing between the radiating plates for a considerable distance, is thoroughly and healthfully warmed without the possibility of being "burned."

THE SMOKE PIPES

also serve as radiating surfaces, the lower or indirect draft pipe being especially serviceable in taking the chill off the incoming cold air.

All the metal inside the linings is radiating surface, the indirect draft causing the lower part and bottom of the radiator to be nearly as hot as the top. The most advantageous

CONSUMPTION OF FUEL

is thus attained. The greatest possible amount of heat being utilized makes the furnace economical in the consumption of fuel; but it must be understood that no stated amount of fuel consumption can be guaranteed. Some purchasers think the furnace consumes more, some less, than other makes they have tried; but they all agree that it does keep their dwellings warm and supplies the purest air.

EVAPORATION OF WATER.

The evaporating pan is ordinarily placed in front of the fire-pot, where the water is boiled away without any regard to the needs of the atmosphere passing through the furnace. To be beneficial, the evaporation of water in furnaces must be *natural* instead of artificial, and to accomplish this effect the water must be warmed by the *air* it is to

moisten and not by the fire. On this principle the evaporating pan in the Durham Furnace is placed above the radiator, beyond the influence of the fire.

The engraving represents our new Patent Evaporating Pan, made of 3½-inch boiler tubes. This pan is indestructable, can not leak, and remains clean. The moisture escapes through the ¼-inch holes drilled on top. The advantages of this pan over those formerly used will be seen at a glance by turning to the frontispiece, where one is shown. It is large enough to extend beyond the top of the radiator, bringing the water surface directly over the ascending warm air.

This application of the principle of natural evaporation is productive of the best results probably attainable in the science of heating. The air being neither overloaded nor deficient in moisture, affords a most delightful relief to the sensitive brain which can not endure the ordinary furnace or steam heat. When one becomes accustomed to the atmosphere of this apparatus, any other seems intolerable. In this connection we quote Mr. Francis Le Barron, editor of the *Furniture Trade Journal:*

AN INVENTION INTERESTING TO THE OWNERS OF FINE FURNITURE.

"This invention is a new furnace, designed with the end in view of supplying warm air to buildings in a pure and natural condition. We have examined this invention carefully and with great pleasure; it seems so perfectly to fill the conditions for which it is intended, and to offer in its construction a '*raison d'etre.*'

"The destructive action of *hot-air* furnaces and steam-heating apparatus on furniture, however well seasoned, is too well known, and has been accepted hitherto as one of the necessary evils of life which had to be endured. Old furniture which had preserved the integrity of its joints for a quarter of a century in some country house is no sooner transported to the city house than the insatiable dry air

attacks and opens every seam. In this invention, the Durham Warm Air Furnace, the result aimed at is secured, and the atmosphere maintained in a naturally moist and thoroughly healthful condition, by an immense increase and peculiar arrangement of the radiating surface, and by such a disposition of the water surface that the water will be warmed by the *air* and not by the *fire;* that is, by substituting *natural* for *artificial* evaporation.

"The Durham Furnace has over 500 square feet of radiating surface, which can not be overheated; and it is guaranteed to receive air at a temperature of 20° below zero, and steadily maintain a temperature of 70°. But it is with the moistening of the air that we have more particularly to deal, and when we consider the fact that a cubic foot of air at zero contains .545 grains of aqueous vapor, and at a temperature of 70° 7.992 grains, or nearly sixteen times as much, we can understand why the dry air of furnaces and steam-heaters seeks to supply itself with moisture from the furniture and wood work. Steam-heating apparatus supplies no moisture whatever; the hot-air furnace usually does (when not neglected by servants), but without regard for the natural capacity for moisture of the air warmed. The water-pan is sometimes full and sometimes dry; when full, the water is usually boiling, and the consequence is that the furniture is subjected first to a swelling and then to a shrinking process from alternate baths of moisture-laden and dry air. The scientific arrangement for the evaporation of water in the Durham Furnace prevents this; and it is commended to the readers of this journal as an apparatus which will not subject fine furniture, buhl-work, marquetry and wood-work, fine carving and inlaid work to the destructive influences which now prey upon them to their utter destruction and ruin, in all artificially warmed atmospheres. How many exquisite inlaid cabinets, how many ivory carvings, are ruined by common furnace heat, not to speak of the cracking of carved picture frames, the creaking chairs and groaning tables, whose every crack has a tongue to cry out against the dryness of the atmosphere in our furnace-heated houses."

THE BLACKENING OF WALLS

and destruction of wall paper and frescoes, so certain with the use of steam coils or orninary furnaces, can be avoided by the use of the Durham Furnace. The cause of this destructive action is to be attributed to two sources, viz: the burning of the minute particles of dust floating in the incoming air by contact with a highly heated radiating surface, reducing the dust to carbon, which is carried through the registers and deposited on wall and furniture, and the escape of coal dust and ashes through the open joints of the furnace. Every-

one has noticed the invariable black streak up the wall over a steam coil; this is simply a deposit of carbon produced by the contact of invisible floating dust with the intensely heated surface of the steam pipes. As the Durham Furnace is *always* tight, and its radiating surface only moderately heated, this annoying feature of heating apparatus is removed. A screen of wire mosquito netting placed over the fresh air inlet will retain in its meshes the greater part of the floating dust, and very materially reduce the labor of house cleaning. But any arrangement will gradually clog in a dirty street, and must be looked after, or the supply of fresh air will be lessened and the furnace held at fault. It is well worth the trouble to use every means to keep dust from passing into the house from the street.

CAPACITY.

It is therefore important to know how many pipes of a given diameter a furnace can fill at all times. This can not be ascertained, for all cases, with exactness, but generally the 34-inch furnace will supply about eleven average sized pipes, and the 40-inch about fifteen, although both sizes have done more work satisfactorily.

The amount of work a furnace can do depends altogether on the proper arrangement of the hot-air pipes, the ventilation of rooms, and the provision of weather strips and double windows. If the cold air is not allowed to escape from a room by chimneys or ventilating flue, the warm air can not enter. If the cold air is allowed to enter through badly fitted doors and windows or thin glass, rooms can not be kept warm by registers. If hot-air pipes are not put in with judgment, they will not deliver warm air successfully.

THE GRATE,

instead of being in one casting, is formed of independent bars, of which each alternate one is movable a distance of three inches. It is lowered one and a half inches below the fire-brick in front, for the removal of clinkers. The long bars are provided with hooked ends, so that they can be pulled in and out by using a poker.

Any of these bars can be instantly displaced and new ones introduced by any person. The destruction of a part of the grate does not necessitate the removal of the whole, as in the case of the ordinary grate. With this arrangement the fire can easily be kept clean; it is never necessary to dump it.

FIRE-BRICK.

The fire-brick is of the best quality, of standard sized brick, to be laid up in fire-clay by the mason who sets the furnace. Purchasers at a distance are thus made independent of the manufacturer, as they can purchase a new set of brick of any dealer.

THE INDIRECT DRAFT

is brought into operation after a fire is burning well, by closing the damper in the direct smoke flue, thus throwing the hot draft over the sides and back of the fire-pot and across the bottom of the furnace, warming all the lower part of the radiating surface. The ashes deposited in the indirect smoke pipe can be removed by lifting the false bottom of the pit.

If any diminution of draft is noticed at any time, it indicates a collection of ashes in the indirect smoke pipe, which must be removed. This may be necessary once or twice in a season.

THE SMOKE PIPES

of the brick-set furnaces, inside the walls are 8 and 9-inch boiler tubes, 3-16 inches thick, *screwed* into the cast iron elbows. Compare this with the same work in other makes of furnaces

The direct (upper) smoke pipe is now taken out under the covering instead of as shown in the frontispiece. Both smoke pipes can be taken out at either side or at the back, as local circumstances may determine.

The great advantages of using large boiler tubes instead of sheet iron smoke pipe, are durability and more perfect security against the escape of coal gas. Even in a very damp cellar, it would be many years before three-sixteenths of an inch of iron would be destroyed by rust. The use of *screw joints* between the tubes and the heavy cast iron elbows is an introduction of mechanical refinement into furnace work hitherto unattempted, requiring the highest class of skilled workmanship on the lathe in cutting the threads.

FUEL.

Either anthracite or bituminous coal can be used. Wood can also be burned, but not to advantage. Cord-wood cut once can be used in the 40-inch, and cut twice for the 34-inch. For spring and autumn, a small wood fire will answer to overcome the evening chill.

THE SPACE REQUIRED

For a 40-inch furnace, is 6 feet square.
For a 34-inch furnace, is 5 feet 2 inches square, which includes a 4-inch brick wall all around.

PRICE.

The prices quoted below are *net* cash. There is no discount, nor do we sell furnaces on trial and wait for payment until purchasers are satisfied that the apparatus will suit them. It will save correspondence if it is understood that we decline to adopt the tactics of the stove trade in forcing sales by offering the various inducements held out by solicitors, of discounts from imaginary price lists and long credit:

40-inch Furnace, - - - - - - - - - $275
34 " " - - - - - - - - - 225

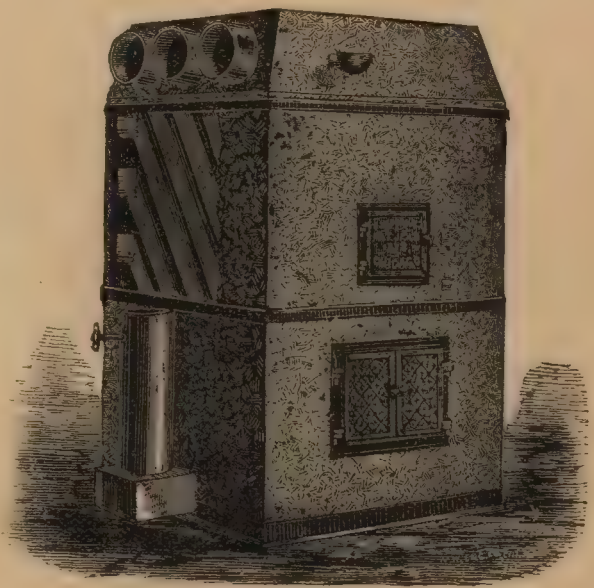
Delivered at the building or free on board cars here. The cost of setting is extra, and will average about $35 for labor, bricks and mortar; all other necessary material required being included in the price quoted for the furnace.

Purchasers at a distance can have their furnaces set by an expert by paying for his time at the rate of $4 per day, and all traveling expenses while away from Chicago.

It will be readily understood that a furnace containing so much metal, and constructed to last twenty-five years, must cost more than one intended to wear out in a few years. The price is placed as low as can be afforded without a prospective income from repairs, and the saving in fuel over other furnaces will probably make up the difference in cost in one season.

THE DURHAM WARM AIR FURNACE.

PORTABLE FORM.



Sold complete, with galvanized iron jacket, in two sizes, as follows:

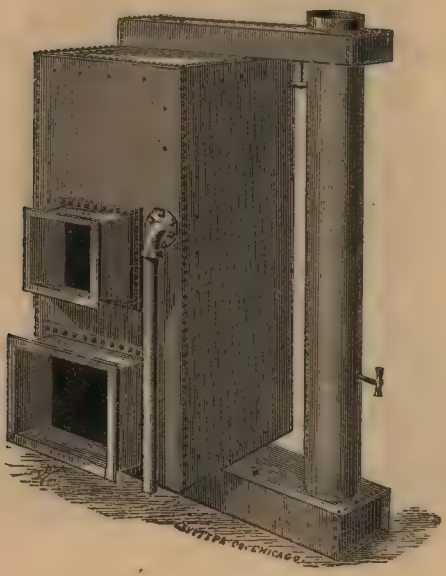
46 inches square outside, - - - - $160

42 " " " - - - - 130

No charge for cartage, or the mere setting up of these furnaces in Chicago, will be made, but the purchasers will be required to pay the cost of preparing the foundations (if necessary), and connecting the hot-air pipes, and for all extra material furnished.

THE PORTABLE FURNACES

Have ~~been used four seasons, and have~~ given great satisfaction only. They differ from the brick-set furnaces in the weight of iron used, which is Nos. 12 and 14 charcoal. We have added to them all the improvements adopted for the higher priced apparatus, and improved the



methods of manufacture. They will answer as auxiliary furnaces in large houses or for the smaller classes of residences, and for stores. ~~Their capacity~~ is about equal to 5 and 8 nine-inch pipes respectively.

With every furnace, we furnish a guarantee that the furnace will fulfill all we claim for it, to the satisfaction of the *purchaser*.

THE DURHAM WARM AIR FURNACES

Have been Purchased by

Mr. L. Z. Leiter (3),
Mr. W. L. B. Jenney,
Mr. C. Counselman,
Mr. E. A. Driver,
Dr. Almon Brooks,
Rev. Herrick Johnson, D. D. (3),
Mr. Henry W. Bishop,
Mr. F. D. Bennett, Jackson, Mich., (6).
Mr. H. N. Mann,
Mr. H. C. Ayer (2)
Mr. R. Strahorn,
Mr. F. J. Kennett (2),
Mr. H. F. Waite,
Mr. Florence McCarthy,
Mr. P. B. Wight,
Mr. Isaac G. Lombard,
Rev. H. Maguire,
Mr. W. C. Larned (3),
Mr. E. C. Larned, (3),
Mr. T. S. Hayden,
Mr. W. M. Greene, Providence, R. I.
Mr. Geo. Barry,
Mr. C. T. Trego,
Mr. C. B. Holmes,
Mr. C. Watrous,
Mr. J. B. Bodle,
Rev. T. H. Skinner,
Rev. D. C. Marquis,
Mr. J. C. Black,
Mr. A. M. Wright,
Mr. Sartell Prentice,
Mr. W. W. Boyington (2),
Mr. W. F. Cobb,
Mr. E. G. Mason,
Mr. C. H. McCormick (5),
Mr. Joseph Medill (2),
Mr. R. Hall McCormick,
Mr. E. W. Blatchford,
Mr. W. C. Whitney, Minneapolis, Minn., (3),
Mr. J. M. Studebaker, South Bend, Ind.
Mr. R. R. Cable,
Mr. J. H. Bell,
North Chicago R. W. Co. (3),
Mr. J. B. Chambers,
Mr. N. E. Swartwout,
Mr. E. Burling,
Mr. J. H. Conrad,
Mr. S. G. Artingstall,

And many others.

LAW OFFICES OF E. C. & W. C. LARNED,
69 Dearborn Street, Rooms 21 and 22,
CHICAGO, Feb. 10, 1881.

DEAR SIR—I take great pleasure in giving your furnace my heartiest endorsement. My house is a very hard one to heat, but with your furnace I have had little trouble, even in the intensest weather of this very severe winter. There is no escape of gas from the furnace, and the atmosphere in rooms heated by it is always fresh and pure. It is simple and vary easily managed, and so well constructed that it seldom gets out of order. Altogether, I think it far superior to any furnace I ever saw.

Very truly yours, WALTER CRANSTON LARNED.

FIFTH NATIONAL BANK.

CHICAGO, July 26, 1883.

DEAR SIR—The Durham furnace which you put in my residence, No. 1819 Indiana avenue, in the fall of 1879, has given entire satisfaction. I can confidently recommend it to my friends as giving a superior quality of heat, and its power and economy are equally gratifying. You can unhesitatingly refer to me as to its merits, if you so desire. Yours respectfully, ISAAC G. LOMBARD.

---

167 RUSH STREET, CHICAGO, Feb. 5, 1881.

DEAR SIR—The furnace which you placed in my house is entirely satisfactory to me in the amount of heat it furnishes, and in the simplicity of its construction. During the exceptionally cold weather of this season, it has kept my house perfectly comfortable, and with no trouble whatever in its management.

Respectfully yours, HENRY W. BISHOP.

OFFICE OF WM. W. BOYINGTON, ARCHITECT.
Cor. Clark and Adom Streets,

CHICAGO, March 1, 1881.

DEAR SIR—It affords me pleasure to report to you that the warm air furnace (*40-inch*) you put in my dwelling last fall has proved a perfect success. With the thermometer at 18° below zero, I had no trouble to keep up a temperature of 65° or 70° Fahrenheit, notwithstanding my house is large and exposed on all sides. I consider your system of evaporation much superior to any other I have ever seen.

The principle of heating and evaporation combined furnishes the very best and purest warm air a person can inhale. I most cheerfully recommend its general use in preference to any warm air furnace I have ever tried, and I have had experience with a large number.

Yours respectfully, WM. W. BOYINGTON,

AUGUST 1, 1883.

I regard the Durham Warm Air Furnace as an admirable heater, and cordially recommend it. HERRICK JOHNSON.

The Durham Wrought Iron Warm Air Furnace.